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Abstract: Background: The aim of this study was to investigate predictors of state-of-the-art management of early breast cancer in Switzerland. Patients and methods: The study included 3499 women aged 25–79 years diagnosed with invasive breast cancer stages I–IIIA in 2003–2005. Patients were identified through population-based cancer registries and treated in all kinds of settings. Concordance with national and international recommendations was assessed for 10 items covering surgery, radiotherapy, systemic adjuvant therapy and histopathology reporting. We used multivariate logistic regression to identify independent predictors of high (10 points) and low (£7 points) concordance. Results: In one-third of the patients, management met guidelines in all items, whereas in about one-fifth, three or more items did not comply. Treatment by a surgeon with caseload in the upper tercile and team involved in clinical research were independent predictors of a high score, whereas treatment by a surgeon with a caseload in the lower tercile was associated with a low score. Socioeconomic characteristics such as income and education were not independent predictors, but patient's place of residence and age independently predicted management according to recommendations. Conclusion: Specialization and involvement in clinical research seem to be key elements for enhancing the quality of early breast cancer management at population level.

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Predictors of state-of-the-art management of early breast cancer in Switzerland

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Results: In one-third of the patients, management met guidelines in all items, whereas in about one-fifth, three or more items did not comply. Treatment by a surgeon with caseload in the upper tercile and team involved in clinical research were independent predictors of a high score, whereas treatment by a surgeon with a caseload in the lower tercile was associated with a low score. Socioeconomic characteristics such as income and education were not independent predictors, but patient's place of residence and age independently predicted management according to recommendations.

Conclusion: Specialization and involvement in clinical research seem to be key elements for enhancing the quality of early breast cancer management at population level.

Key words: adherence guidelines, breast cancer, patterns of care, practice patterns, quality, retrospective study

introduction

Two recently published studies have described geographical disparities in breast cancer mortality [1] and 5-year relative survival rates in Switzerland after controlling for prognostic factors like tumor size and nodal status [2]. These differences suggest that factors other than stage at diagnosis might influence clinical outcome. In fact, geographical heterogeneity in the process of care (early detection and treatment) has been reported recently [3]. It remains unclear whether these regional disparities are associated with differences in access to specialized breast cancer care.

The Swiss health care system is characterized by universal health care insurance coverage, readily available access together with liberalism in and fragmentation of care provision. Although treatment of breast cancer in specialized units has been shown to result in better outcomes [4–7], there is still much debate whether specialization in breast cancer care is needed and whether differences that matter to the patient exist in Switzerland.

Many studies have evaluated the relation between the characteristics of the source of care and the outcomes of patients with breast cancer in developed countries. Characteristics of both patients and health care providers [8] have been related to these variations. Hospital and physician volume [9], specialization [10, 11], participation in research [9], multidisciplinary teams [12] and treatment in accordance to guidelines [13] have been found to affect both the way patients are cared for and the outcomes. Variations in treatment include type of breast and axillary surgery, and use of chemotherapy, hormone therapy and radiation therapy. Switzerland devotes 10.8% of its gross domestic product for health and its health care system is one of the most expensive among developed countries [14, 15]. Little is known, however, on how the system functions and patients cannot easily recognize where specialized high-quality care is provided. The aim of the present study was, therefore, to analyze whether

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differences in the implementation of state-of-the-art management exist and find predictors for adequate and poor management of early breast in Switzerland.

methods

A 10-item score of state-of-the-art management was defined based on national [16–20] and international [21–27] guideline items available at the time diagnosis was made and treatments were provided. The score included five items for surgical management, one item for histopathology reporting, and four items for adjuvant radiotherapy and systemic treatment. One point was given for complying with each respective item or when the recommendation was not requested by the guideline for the individual case. Details on items of the score are given in Table 1.

study population

Patients were identified from seven population-based cancer registries and were included in the Swiss Patterns of Care in Breast Cancer Study (Swiss PoC), which analyzed breast cancer cases diagnosed between 1 January 2003 and 31 December 2005 [28]. For this analysis, we included 3499 women with early breast cancer (stages I–IIIA according to [29]). We restricted our cohort to patients aged 25–79 years diagnosed with epithelial malignancies (International Classification of Diseases for Oncology-3 codes M8010-M8579) and operated with curative intention. We excluded women 80 years and older as this population is heterogeneous with respect to factors such as number of comorbidities and life expectancy, and the lack of adherence to recommendations may be related to such factors. Only one tumor per patient was considered. The index tumor was defined as being the one with higher stage according to Greene et al. [29] in case of synchronous bilateral tumor (e.g. diagnosis made within 30 days) or the first diagnosed in the period of interest in case of metachronous independent bilateral breast cancer.

The participating cancer registries cover roughly 3.5 Mio inhabitants (47% of the Swiss population) and are regular contributors to 'Cancer in 5 Continents' [30, 31]. Routine indicators of data completeness and quality of the participating registries are good: 1%–3% of case patients are registered on the basis of death certificates only. The proportion of histological verification is >90% [30, 31]. Details of the methodology are provided elsewhere [28]. In brief, based on the requirements of the European Society of Mastology (EUSOMA) Audit system on Quality of Breast Cancer Treatment criteria [32], a database was designed and a special software application for data entry distributed to the registries to minimize data entry errors. Items included detailed information on patient and tumor characteristics, diagnosis circumstances and treatments planed and delivered as part of the first therapeutic concept. Therapies planned and delivered because of recurrence or disease progression were not considered. Experienced staff of the registries was centrally instructed and trained, subsequently data items abstracted from pathology reports and medical charts. To complete information on therapies delivered in the outpatient setting or for pieces of information lacking in the hospital charts, questionnaires were sent to family doctors or treating gynecologists. The use of questionnaires complementary to chart review allowed high completeness of information concerning adjuvant therapies (>95%). Registries could choose between collecting information on all registered and eligible cases or on a random sample of at least 500 cases. Five registries (Geneva, Valais, Ticino, St Gallen–Appenzell and Grisons–Glarus) collected information on all registered cases diagnosed in their respective catchment areas in the study period, whereas two registries (Basel city and countryside and Zurich) collected information on a sample of 505 cases selected at random. Tests of representativeness of the samples of those two registries regarding age distribution, breast cancer laterality, morphology

Table 1. Items used to construct the state-of-the-art breast cancer management score and adherence to items

	No. of patients (%)		References
	1 point	0 point	
Surgical items			
Pretreatment diagnostic by FNA or CNB	2687 (76)	812 (24)	[17, 23]
≥1-mm tumor-free margin after final surgery[a]	3199 (91)	300 (9)	[16]
Removal of ≥10 LN when undergoing AND	1657 (47)	649 (18)	[18]
Not requested[b]	1193 (34)	–	
Sentinel node as definitive procedure in pathologically confirmed N0 disease	1119 (34)		[18, 22]
Not requested[b,c]	1158 (34)	1160 (33)	
One breast surgery[d]	2674 (76)	825 (24)	[23, 26, 27]
Nonsurgical items			
Reporting of hormone receptor immunoreactivity (in % positive cells), tumor size and grading	3426 (96)	73 (2)	[17, 24]
Nonapplicable[e]	51 (1)	–	
Adjuvant radiotherapy following BCS	2348 (67)	151 (4)	
Not requested[f]	964 (29)	–	[19, 25]
Adjuvant radiotherapy following mastectomy if requested[g]	236 (7)	136 (4)	
Not requested[h]	3217 (89)	–	[19, 25]
Endocrine therapy prescribed if requested[i]	2720 (78)	170 (5)	[20, 22]
Nonapplicable[j]	609 (17)	–	
Chemotherapy prescribed when requested[k]	1455 (43)	324 (9)	
Nonapplicable[l]	1720 (49)	–	[20, 22]

Percentages may not sum up to 100 because of rounding.
[a]For both invasive and *in situ* breast cancer.
[b]Not requested in patients receiving neoadjuvant systemic chemotherapy or if sentinel node biopsy in node-negative disease was carried out.
[c]Not requested in patients with positive lymph nodes.
[d]To achieve negative margins as well as axillary procedure.
[e]Not requested if not mentioned in patients with neoadjuvant chemotherapy.
[f]Not requested if mastectomy was carried out or the patient refused radiotherapy.
[g]Requested for patients with locally advanced disease or positive margins.
[h]Not requested if BCS was carried out or mastectomy carried out with characteristics other than those specified in the footnote above ([g]) or if the patient refused radiotherapy.
[i]Requested if endocrine-sensitive disease except minimal risk according to Goldhirsch et al. [22].
[j]Not requested if minimal risk or endocrine-unresponsive disease.
[k]Chemotherapy requested for endocrine-unresponsive disease and for endocrine-responsive disease if nodal involvement and locally advanced disease (facultative for high histological grade, vessel invasion or HER2 overexpression).
[l]Nonapplicable if chemotherapy not prescribed and not requested by guideline.
AND, (conventional) axillary node dissection; BCS, breast-conserving surgery; CNB, core needle biopsy; FNA, fine needle aspiration; LN, lymph nodes.

and stage showed similar values as those of registries that had collected the totality of cases. Breast cancer staging used the 6th edition of the American Joint Committee on Cancer staging criteria [29]. The study was submitted to and accepted by the Cantonal Ethics Committee in St Gallen, where the study center is located.

Socioeconomic covariates studied in the present analysis included age, nationality (as proxy for migrant), canton of residence, urban/suburban versus rural residence and affluence categorized to the highest quartile of median income in the small residence area in the Swiss PoC population. The level of education attained (tertiary education versus other) was derived from the type of occupation of the patient.

Provider characteristics included setting of the initial therapy (surgery in a public versus private hospital), patient discussion at a pre- and postoperative or only postoperative multidisciplinary tumor conference (MDTC) (including at least a surgeon, pathologist, radio-oncologist and medical oncologist), involvement of the team in clinical research and estimated number of breast cancer patients per surgeon and year. This number was calculated from the number of cases recorded by the registry and weighted for sampling probability. For institutions in the public sector, it was assumed that three surgeons per institution operated on breast cancer patients. In private hospitals, each surgeon received a distinct anonymous code. All information on provider characteristics was lacking for the region Ticino and caseload could not be determined for patients treated in the private setting in Basel as individual surgeons did not receive a distinct code. Data from these registries could not be used for the multivariate analysis and were analyzed separately.

statistical analysis

Socioeconomic and procedural covariates were compared with individual scores. Pearson's correlation was used to analyze the strength of the relationship of items within the score, whereas the Student's *t*-test and analysis of variance were used to compare mean scores across different groups. Bonferroni correction was applied when comparing multiple groups.

Logistic regression analysis was carried out to find predictors for the prospectively defined high (10 points) and low (≤7 points) concordance in univariate and multivariate analysis. In multivariate models, we included all variables significantly linked to high or low scores in univariate analysis. Because of the geographical disparities present, we tested the robustness of our results by excluding one region at a time. Sensitivity analysis was carried out to test assumptions of nondependence of results on any specific region. All tests of significance were two sided; $P < 0.05$ was considered to be significant. All statistical analyses were carried out using STATA 10.1 software (STATA Corp., College Station, TX).

results

Results of adherence to each of the items are detailed in Table 1. Compliance with recommendations in surgical items was poorer than in nonsurgical items. Among nonsurgical items, noncompliance with recommendations of systemic therapies was higher than for radiotherapy items.

Table 2 presents mean scores of state-of-the-art management of breast cancer according to patient and tumor characteristics as well as surgeon experience, multidisciplinary approaches and involvement of the team in research. Mean total score was 8.64 [95% confidence interval (CI) 8.60–8.68, range 3–10]. A total of 1147 patients (33%) had a score of 10 and 671 patients (19%) a score of 7 or less. A high correlation was found between the total score and the surgical subscore [coefficient of regression (r) = 0.88, $P < 0.001$) as well as between the total score and nonsurgical subscore ($r = 0.57$, $P < 0.001$), whereas the correlation between surgical and nonsurgical subscores was weak ($r = 0.12$, $P < 0.01$).

Most patients (95%) were treated within their canton of residence and two-thirds in public hospitals.

Patients with tertiary education and living in an urban or suburban area, and particularly in Geneva, had higher mean and surgical scores. This was also observed for migrants (Table 2).

One-third of patients were operated by surgeons with an estimated caseload of six or less new breast cancer patients per year. No significant differences in total or surgical subscores were observed between patients operated by surgeons in the intermediate (7–26 patients per surgeon and year) and low tercile (≤6 patients per surgeon per year) (8.67 and 3.84, respectively, versus 8.54 and 3.84, $P = 0.47$). Both groups were therefore considered together as low–intermediate group. Patients treated by surgeons in the high-tercile category of caseload (≥27 patients per surgeon per year) had a significantly higher score (9.20 versus 8.54, $P < 0.01$) and surgical subscore (4.37 versus 3.85, $P < 0.01$) than those treated by surgeons in the low–intermediate group. Moreover, patients treated by surgeons in the high-tercile group also had significantly higher nonsurgical subscore than those treated in the low–intermediate-tercile group (4.83 versus 4.73, $P < 0.01$).

Discussion in an MDTC as defined previously was associated with significantly higher mean total scores, higher surgical subscore and higher nonsurgical subscore. The differences are more clear-cut for patients discussed pre- and postoperatively. In patients with missing information on caseload or MDTC, all scores, total, surgical and nonsurgical, were significantly lower (Table 2). Patients treated by physicians and institutions participating in clinical research had a significantly higher total, surgical and nonsurgical subscores (Table 2). When all three characteristics were present (high caseload, MDTC and participation in clinical research), the total score was 9.28 and the likelihood of a high score was three times higher (odds ratio 3.06, 95% CI 2.56–3.66, $P < 0.01$). The setting (public/private hospital) was not a predictor for high-score category neither in univariate nor in multivariate analysis, but setting was associated with a small but statistically significant difference in score (Table 2). Missing information on the type of setting was associated with low total (8.25, 95% CI 8.14–8.36), surgical and nonsurgical scores.

Table 3 presents the effect of each factor on the probability of having a high or low score of state-of-the-art treatment. In univariate analysis, all patient characteristics studied were significantly associated with both high and low score, except stage, which was significantly linked to low management score only. In multivariate analysis controlling for all other variables, the effect of educational status, income category and MDTC on high or low treatment score lost significance. Only place of residence, surgeon caseload and research team experience remained independently associated to a high score (Table 3). In particular, surgeon caseload in the upper tercile and participation in clinical research were associated with a 43% and 42% increased chance to receive treatment according to recommendations.

Table 2. Patient and tumor characteristics and mean scores of state-of-the-art management of breast cancer according to patient, tumor and provider characteristics

Characteristic	No. of patients (%)	Mean total score (95% CI)	Mean surgical score (95% CI)	Mean nonsurgical score (95% CI)
All	3499 (100)	8.64 (8.60–8.68)	3.93 (3.89–3.96)	4.71 (4.69–4.73)
Age (years)				
<35	71 (2)	8.79 (8.46–9.12)	4.03 (3.76–4.30)	4.76 (4.62–4.90)
35–49	787 (22)	8.64 (8.55–8.74)	3.86 (3.78–3.94)	4.78 (4.74–4.81)
50–65	1481 (42)	8.70 (8.64–8.77)	3.96 (3.90–4.01)	4.74 (4.71–4.77)
65–79	1160 (33)	8.55 (8.47–8.63)	3.92 (3.87–3.99)	4.62 (4.58–4.67)
Nationality				
Swiss	2929 (84)	8.61 (8.56–8.66)	3.89 (3.85–3.93)	4.71 (4.69–4.74)
Foreigner	570 (16)	**8.81 (8.71–8.91)**	**4.12 (4.03–4.20)**	4.69 (4.64–4.75)
Residence				
Urban/suburban	2791 (80)	**8.72 (8.67–8.77)**	**4.00 (3.96–4.04)**	4.72 (4.70–4.74)
Rural	708 (20)	8.32 (8.22–8.41)	3.63 (3.55–3.71)	4.68 (4.64–4.74)
Education				
Tertiary	333 (10)	**8.95 (8.82–9.08)**	**4.17 (4.06–4.27)**	4.78 (4.71–4.84)
Other/unknown	3166 (90)	8.61 (8.56–8.66)	3.90 (3.86–3.94)	4.71 (4.68–4.73)
Income category				
High	704 (20)	8.77 (8.67–8.87)	**4.08 (4.00–4.16)**	4.69 (4.64–4.74)
Others	2795 (80)	8.61 (8.56–8.66)	3.89 (3.85–3.94)	4.72 (4.69–4.74)
Canton of residence				
GE	848 (24)	**9.20 (9.12–9.27)**[a]	**4.38 (4.32–4.45)**[a]	4.82 (4.79–4.86)
VS	446 (13)	8.46 (8.35–8.57)	3.60 (3.50–3.70)	4.87 (4.83–4.90)
TI	572 (16)	8.27 (8.15–8.38)	3.69 (3.60–3.79)	4.57 (4.52–4.63)
BA	356 (10)	8.47 (8.32–8.63)	3.84 (3.73–3.97)	4.63 (4.56–4.70)
ZH	379 (11)	8.62 (8.48–8.76)	4.06 (3.96–4.16)	4.56 (4.47–4.65)
SGA	608 (17)	8.62 (8.51–8.72)	3.81 (3.73–3.90)	4.79 (4.75–4.84)
GG	290 (0.8)	8.30 (8.15–8.46)	3.76 (3.62–3.86)	4.56 (4.48–4.65)
Stage				
I	1564 (45)	8.57 (8.50–8.64)	3.85 (3.79–3.91)	4.72 (4.69–4.75)
II–III	1935 (55)	8.70 (8.64–8.76)	**3.99 (3.95–4.04)**	4.71 (4.68–4.74)
Receptors				
ER and PR negative	561 (16)	8.54 (8.43–8.65)	3.87 (3.77–3.96)	4.68 (4.63–4.73)
ER or PR positive	2912 (84)	8.68 (8.63–8.73)	3.95 (3.91–3.99)	4.74 (4.72–4.76)
Histological grading				
Low–intermediate	2621(76)	8.71 (8.67–8.76)	3.94 (3.90–3.98)	**4.77 (4.75–4.80)**
High	824 (24)	8.47 (8.38–8.57)	3.91 (3.84–3.99)	4.56 (4.52–4.61)
Surgical caseload				
Low–intermediate	1791 (51)	**8.54 (8.52–8.64)**[a]	3.85 (3.80–3.90)	4.73 (4.70–4.76)
High	808 (23)	**9.20 (9.13–9.27)**[a]	**4.37 (4.30–4.43)**	**4.83 (4.80–4.86)**
Unknown	900 (26)	**8.26 (8.16–8.35)**[a]	3.68 (3.61–3.76)	4.56 (4.52–4.61)
MDTC, pre- and postoperative				
No discussion	2194 (63)	**8.64 (8.59–8.69)**[a]	3.86 (3.81–3.91)	4.78 (4.75–4.80)
Yes	600 (17)	**9.23 (9.15–9.31)**[a]	**4.40 (4.33–4.47)**[a]	**4.83 (4.79–4.86)**[a]
Unknown	705 (20)	**8.13 (8.03–8.23)**[a]	3.73 (3.64–3.81)	4.40 (4.34–4.72)
Clinical research				
No	1631 (46)	**8.44 (8.37–8.51)**[a]	3.79 (3.74–3.84)	**4.65 (4.62–4.69)**[a]
Yes	1279 (37)	**9.07 (9.01–9.13)**[a]	**4.21 (4.15–4.26)**[a]	**4.87 (4.85–4.89)**[a]
Unknown	589 (17)	**8.24 (8.13–8.36)**[a]	3.70 (3.61–3.79)	**4.54 (4.49–4.60)**[a]

Values in bold indicate statistically significant results.

[a]Significantly different to all others with Bonferroni correction.

BA, Basel; CI, confidence interval; ER, estrogen receptor; GE, Geneva; GG, Grisons–Glarus; MDTC, multidisciplinary tumor conference; PR, progesterone receptor; SGA, St Gallen–Appenzell; TI, Ticino; VS, Valais; ZH, Zurich.

Significant and independent association with low management scores was observed for age, residence in a rural area, canton of residence, and tumor and provider characteristics (Table 3). In particular, older women aged 65–79 years have a 34% increased probability of having a low treatment score compared with younger postmenopausal

Table 3. Relationship between patient, tumor and provider factors as predictors of high (10 points) and low (≤7 points) scores

Characteristic	High (10 point) management score				Low (≤7 point) management score			
	Univariate		Multivariate		Univariate		Multivariate	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Age (years)								
<35	1.31	0.80–2.14	1.22	0.66–2.25	0.82	0.42–1.58	0.90	0.38–2.12
35–49	0.92	0.76–1.10	0.82	0.65–1.04	1.01	0.81–1.26	1.20	0.89–1.64
50–65	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
65–79	**0.83**	**0.70–0.98**	0.82	0.67–1.01	**1.29**	**1.06–1.56**	**1.34**	**1.03–1.75**
Nationality								
Swiss	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
Foreign	**1.38**	**1.15–1.66**	1.06	0.83–1.35	**0.71**	**0.56–0.91**	0.86	0.67–1.34
Residence								
Urban/suburban	Ref	Ref	1.0	Ref	1.0	Ref	1.0	
Rural	**0.42**	**0.36–0.52**	**0.68**	**0.51–0.90**	**1.55**	**1.27–1.89**	**1.39**	**1.03–1.87**
Education								
Tertiary	**1.62**	**1.29–2.04**	0.96	0.74–1.26	**0.50**	**0.35–0.71**	0.72	0.47–1.09
Other/unknown	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
Income category								
Upper quartile	**1.40**	**1.17–1.67**	0.93	0.74–1.18	0.82	0.66–1.01	0.98	0.69–1.38
Others	1.00	Ref	1.0	Ref	1.0	Ref	1.0	Ref
Canton of residence								
GE	**5.25**	**3.79–7.28**	**2.92**	**1.97–4.33**	**0.28**	**0.20–0.40**	**0.57**	**0.36–0.90**
VS	1.26	0.87–1.83	1.30	0.85–2.01	0.84	0.59–1.19	0.72	0.48–1.09
TI	1.16	0.81–1.67	–	–	1.10	0.80–1.53	–	–
BA	**2.08**	**1.43–3.02**	–	–	0.99	0.69–1.42	–	–
ZH	**2.33**	**1.62–3.37**	**1.95**	**1.27–3.01**	0.80	0.55–1.14	1.03	0.65–1.65
SGA	**1.83**	**1.30–2.59**	1.12	0.76–1.64	**0.67**	**0.48–0.94**	1.19	0.81–1.77
GG	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
Stage								
I	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
II–III	0.94	0.81–1.09	1.03	0.87–2.25	**0.70**	**0.59–0.83**	**0.47**	**0.37–0.59**
Receptors								
ER and PR negative	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
ER or PR positive	1.17	0.96–1.43	1.12	0.84–1.49	**0.78**	**0.63–0.98**	0.89	0.63–1.25
Histological grading								
Low–intermediate	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
High	**0.72**	**0.62–0.87**	0.83	0.65–1.07	**1.36**	**1.13–1.65**	**1.45**	**1.08–1.95**
Surgical caseload								
Low–intermediate	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
High	**2.57**	**2.16–3.04**	**1.43**	**1.07–1.91**	**0.32**	**0.24–0.43**	**0.43**	**0.27–0.67**
MDTC, pre- and postoperative								
No	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
Yes	**2.96**	**2.47–3.54**	1.23	0.90–1.66	**0.30**	**0.23–0.42**	1.28	0.78–2.11
Clinical research								
No	1.0	Ref	1.0	Ref	1.0	Ref	1.0	Ref
Yes	**2.29**	**1.96–2.67**	**1.42**	**1.11–1.82**	**0.34**	**0.28–0.43**	**0.54**	**0.40–0.74**

Values in bold indicate statistically significant odds ratios and 95% CI. Dash (–) indicates category dropped in the multivariate model because of missing data for one of more covariates.

BA, Basel; CI, confidence interval; ER, estrogen receptor; GE, Geneva; GG, Grisons–Glarus; MDTC, multidisciplinary tumor conference; PR, progesterone receptor; Ref, reference; SGA, St Gallen–Appenzell; TI, Ticino; VS, Valais; ZH, Zurich.

women. Surgeon caseload lower than the upper tercile and lack of participation in clinical research were associated with a 57% and 46% increased risk of having a low treatment score.

Because of geographical disparities present, we tested the robustness of our results by excluding one region at a time. Sensitivity analysis confirmed the robustness of the results.

discussion

This population-based study reports that provider characteristics as well as area of residence are important and independent predictors of adherence with recommendations for management of early-stage breast cancer. In particular, high

surgeon experience in term of the number of breast cancer patients treated (in this study >26 per year) and his or her team involvement in clinical research are key determinants of use of state-of-the-art management. Other factors such as patient's education, income and nationality, and MDTC are not independent predictors of adequate management.

The influence of organizational factors on the process of care and outcomes of breast cancer has been extensively investigated in many countries. Hospital characteristics that have been reported to positively affect treatments and outcomes include teaching status [33–35], patient volume [34, 36–39], on-site availability of specialized services needed for treatment [40–42], discussion in multidisciplinary case conference [12] and involvement in clinical research [43]. The results of our study are in accordance with those reports. Patients treated in institutions with high surgical caseload, with MDTC (especially when this takes place before and after surgery) and with involvement in clinical research resulted in an increased number of items concordant with recommendations and guidelines. Especially, surgical items as preoperative diagnosis and sentinel node biopsy in patients with node-negative disease showed large variability.

The need for specialized breast units has been put forward by the reports 'A Policy Framework for Commissioning Cancer Services' [44] and 'The Florence Statement' [45], in 1995 and 1998, respectively. In 2000, EUSOMA published a list of requirements of a specialist breast unit [46] including multidisciplinary teams and members of the core team spending at least half their working time in breast cancer. The objectives of such units are to make a high-quality specialized breast service available for all women, to define standards and by means of accreditation to make this service recognizable to patients, practitioners and health authorities as being of high quality. Until the end of 2005, when the observation period of this study ceased, only few specialized breast units were available for patient care in Switzerland.

In Switzerland, ~5200 patients are diagnosed with breast cancer each year [47] and treated in nearly all 130 public and private hospitals throughout the country. Because of this fragmentation, only few centers reach the critical mass of more than 150 newly diagnosed cases of primary cancer as required by EUSOMA. The importance of specialization and multidisciplinary approach is also reflected in our results. Patients treated by surgeons in the upper tercile of caseload had not only higher surgical scores but also better nonsurgical scores. Even if care by general surgeons and gynecologists without specialization can be excellent for common types of breast cancer, lack of specialization can be critical in cases of nonpalpable mass, multicentricity or special biological tumor and patient characteristics.

Among patient characteristics, older age, canton of residence and living in a rural area were the only independent predictors of low score, whereas tertiary education and income were not. Our results are in accord with other studies showing that although health disparities still exist in Switzerland, they are smaller than the average among the European countries [48]. Geographical disparities described in other studies [1–3] are confirmed in our results and can be only imperfectly explained by the covariates analyzed. Training policies and other decisions concerning hiring and equipment taken many years ago may influence the quality of care in the present study. More research is needed to fully understand the causes of this variability. The high degree of compliance with recommendations found in patients living in the canton of Geneva is remarkable. A possible (but probably incomplete) explanation is that in Geneva, most of the predictors of high management score are present: high caseload and clinical research at the university hospital, higher proportion of patients with tertiary education, income in the highest tercile and living in an urban area with high accessibility to specialized care. The rather surprising finding that scores of nonnationals were higher than those in nationals can be explained by the high proportion of foreigners being treated by surgeons in the high tercile of caseload (44% of foreigners versus 29% of nationals, $P < 0.01$).

Important strengths of this study are (i) that thanks to identification of cases through cancer registries we have been able to study patients in the community setting, in all type of practices; (ii) that by using a tool developed to asses quality we could assess a greater number of elements relevant for practice; (iii) the fact that parameters, their exact definition and categorization as well as the methodology of analysis had been defined prospectively; (iv) the high degree of completeness of data on adjuvant therapies and (v) that through the external approach we were able to avoid biases related to self-selection and self-reporting by caregivers. Moreover (vi), the time gap assured a more complete registration of patients not treated in centers or not treated at all, further reducing a possible selection bias [49].

Limitations of the study are related to the retrospective perspective of data collection. Furthermore, almost half of the population of Switzerland was not represented in the study because of lack of population-based cancer registries in these areas. However, the different linguistic regions of the country as well as rural and urban populations are represented in this study. Missing data on providers probably reduce the efficiency of the analysis by enlarging CIs. We do not believe, however, that it introduces any bias because it is concentrated on one region (Ticino) and the private sector of the other (Basel). Moreover, sensitivity analysis showed that the results are not dependent on any specific region. As with most observational studies, unobservable as well as unobserved differences between those receiving standard, guideline congruent therapies and those receiving nonstandard therapies are very likely to play a role in the patterns of care we observed.

In the past few years, increasing awareness of variations in the quality of health care across geographic areas as well as providers has helped to propel a quality improvement movement. In a system characterized by freedom of choice of provider, the importance of an informed choice of referring physicians and patients is paramount. The introduction of accredited breast units in the near future will increase transparency, facilitate this informed choice and contribute to reduce disparities.

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disclosure

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